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(71) Applicant: QUALCOMM INCORPORATED [US/US]; 5775 Morehouse Drive, San Diego, CA 92121-1724 (US).

(72) Inventor: LEUNG, Nikolai, K., N.; 7710 Takoma Avenue, Takoma Park, MD 20912 (US).

(74) Agents: OGROD, Gregory, D. et al.; Qualcomm Incorporated, 5775 Morehouse Drive, San Diego, CA 92121-1714 (US).

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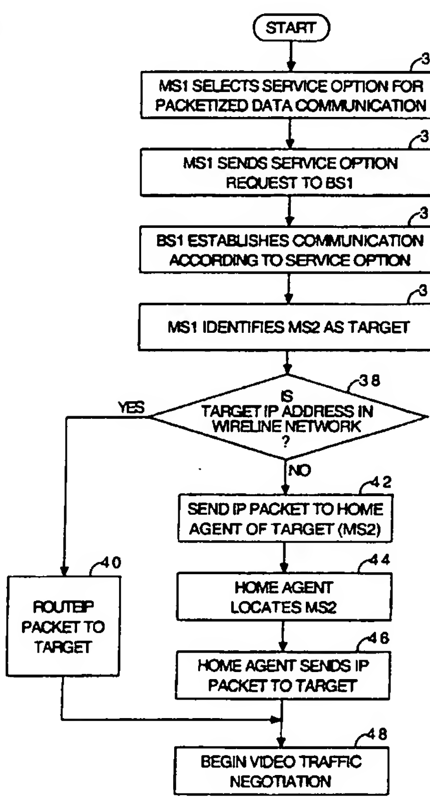
(54) Title: METHOD AND APPARATUS FOR WIRELESS VIDEO COMMUNICATION



(57) Abstract: Method for wireless video communication using a high data rate packet data service and mobility management. In one embodiment mobile users (MS1 4, MS2 14, MS3 24) transact a video conference call sending the real-time data in packetized format. Mobility management allows location of each user according to an Internet Protocol (IP). In one embodiment, each mobile user communicates through a Session Initiation Protocol (SIP) type server (SIP1 108, SIP2 118, SIP3 128), which allows a mobile station to be located as it roams outside of its home network. The home SIP server provides a new SIP server location when a user moves outside of the home network (105, 115, 125). In an alternate embodiment, the users employ a Mobile-IP service, allowing each to have a persistent IP address, where mobility management functions inform a home agent (PDSN1 8, PDSN2 18, PDSN3 28) of the mobile user's location.

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METHOD AND APPARATUS FOR WIRELESS VIDEO COMMUNICATION

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to wireless data communications. More particularly, the present invention relates to a novel and improved method for wireless data communication between mobile users and is applicable to video conferencing and other video applications.

II. Description of the Related Art

Wireless communication of data information typically involves a mobile user accessing a wireline data network, where, for example, a cell phone or electronic personal assistant is used to access the Internet. As the transmission of data information does not require real-time processing, the data rate may increase beyond that available for audio communications, which are transmitted in real-time and require highly reliable communication links. Data services packetize the data prior to transmission. Packetizing data allows for increased speed and accuracy of communication, and is therefore desirable for wireless data communications. The application of high rate packet data transmission in a Code Division Multiple Access (CDMA) system is disclosed in the Patent Application entitled "METHOD AND APPARATUS FOR HIGH RATE PACKET DATA TRANSMISSION," having Application Number 08/963,386, filed November 3, 1997, assigned to the assignee hereof, and expressly incorporated by reference herein.

In efforts to integrate wireless and other communication media with the Internet, an increasing number of applications are being developed using a standard Internet Protocol, or IP. This Protocol is a software standard that describes how to track Internetwork addresses, route messages, and recognize incoming messages, thus allowing a packet of data to traverse various networks on its way from originator to target recipient. The originator is the mobile unit initiating the communication, and the target is the desired participant. Within an IP network, each resource, such as a computer, is assigned an IP address for identification.

In many applications, the user is able to access the Internet from a mobile resource to check e-mail, get stock quotes, etc. In this scenario, while the user is mobile, the data network is located at a fixed location and may therefore be identified through a known addressing mechanism, such as a Domain Name Server (DNS). When the mobile user or Mobile Station (MS) desires access to the wireline data network, the mobile identifies itself and its location to a Base Station (BS). There is no corresponding need for such identification of the data network as it is considered a fixed resource and is located through the DNS. A problem exists, however, if the mobile user seeks to transact data communications with another mobile user. This occurs, e.g., in the case of a video conferencing call between mobile users, and there is a need for the originator to locate the target mobile resource. As the target resource does not have a fixed location, the communication must be able to locate the target in order to complete the communication.

In a mobile communication system, service options designate the type of service and specify how the data is used on receipt. According to "TIA/EIA-95 Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System," herein referred to as the IS-2000 standard, a "service option" is a service capability of a CDMA communication system. Service options may be applications such as voice, data, or facsimile. Within the CDMA2000 standard, Packet Data Service (PDS) is a service option that allows mobile users to access the Internet. Data is provided as packets of information according to a predetermined format that is readily applicable to Internet communications. It is desirable to extend PDS to video communications to allow for high speed transmission of large amounts of video information. A problem exists as data services do not consider the dynamic location of mobile hosts.

A need therefore exists for a method for high speed data transactions between mobile users, and specifically for a method of performing video conferencing between users in a communication system. Further, there is a need for a method of carrying out a mobile-terminated, real-time communication in a system supporting host migration.

SUMMARY OF THE INVENTION

One aspect of the present invention provides a novel and improved method of communicating video information in a wireless communication

system using a Packet Data Service (PDS) service option. As the volume of video information is large in comparison to audio communications, the high data rates available using PDS facilitate faster, more efficient video communications. A method for wireless video communication using a high data rate packet data service incorporates mobility management techniques, such as Mobile-IP or the use of Session Initiation Protocol (SIP) servers. The communication is performed via an IP network in which packets of data are directed according to IP-type addresses and/or locators. In one embodiment mobile users transact a video conference call sending the real-time data in packetized format. Each mobile user notifies a SIP-type server of its location as it moves between different radio networks. When a call is addressed to a mobile station that has moved out of its home network, the home SIP server provides the new mobile location via standard SIP procedures. In an alternate embodiment, the users employ a Mobile-IP protocol, allowing each to have a persistent IP address, where mobility management functions inform a home agent of the mobile user's location. Note that a Mobile-IP protocol may be combined with the use of the SIP protocol within one communication system.

According to another aspect of the present invention, a method for a real-time data communication includes selecting a packet data service option, selecting a target mobile participant, establishing an Internet Protocol (IP) communication with the target mobile participant, and negotiating video traffic with the target mobile participant using the packet data service option.

According to still another aspect of the present invention, a method for a video communication includes selecting a packet data service option for the video communication, identifying a target mobile participant, determining a home agent for the target mobile participant, the home agent locating the target mobile participant, sending a first packet of video data to the target mobile participant via the home agent, and negotiating video traffic with the target mobile participant.

According to yet another aspect of the present invention, a mobile unit includes a first set of computer readable instructions for initiating a packet data service option, a second set of computer readable instructions for identifying a target mobile participant, a third set of computer readable instructions for sending a first packet of video data to the mobile participant, and a fourth set of computer readable instructions for negotiating video traffic with the target mobile participant.

BRIEF DESCRIPTION OF THE DRAWINGS

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

FIGs. 1 and 2 illustrate a communication system including wireless mobile resources and a wireline IP network according to one embodiment of the present invention;

FIGs. 3 and 4 are flow diagrams describing a video conference communication between mobile users within a communication system as in FIG. 1;

FIG. 5 illustrates a communication system including wireless mobile resources and a wireline IP network according to an alternate embodiment of the present invention; and

FIGs. 6 and 7 illustrate the flow of information in a communication system as in FIG. 5 according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following discussion presents one embodiment of the present invention in a communication system including both wireless and wireline resources coupled to an IP network. The communication described is between multiple mobile users via the IP network. In one embodiment of the present invention, a mobile user establishes a video conference call with another user, sending the real-time video data information as packetized data using a specific high data rate packetized service option within the communication system. Rather than a telephone number, an IP locator or IP address identifies each mobile user or participant to the call. The IP address may be a constant address assigned to a mobile user, where messages are forwarded throughout the system as the mobile user changes location and moves from one network to another. In an alternate embodiment, the IP address of the mobile user is amended to reflect its new location, where additional IP address(es) information are combined with the mobile user's IP address.

Current Internetworking protocols, such as Transmission Control Protocol (TCP), Internet Packet eXchange (IPX), and Appletalk, assume a fixed contact location. In accordance with such protocols, each computer or host is attached to a network and the network is identified by a unique IP address. In this way, the IP address contains fixed location information for each host. In contrast, mobile computing often requires computer migration, or host migration, where the host changes dynamically. In a mobile system, the mobile host may move from network to network while retaining the same IP address. The IP address identifies the mobile host and will change to reflect a new point of attachment as the mobile moves. Existing routing protocols are not able to route information to a mobile host, but rather require the mobile host to reconfigure each time there is a network connection change. In a cellular communication system, for example, this would require the mobile unit to reconfigure its IP information every time it moves from one group of cells to another. This incurs a time-consuming routine for the mobile and a problem of informing other users of the new IP address. Additionally, under existing protocols, during communication, any established transport layer connections, such as ftp or telnet sessions, will be lost on the change of IP address by the mobile host.

An extension of the existing protocols to mobile users is a protocol referred to as "Mobile-IP." Mobile-IP allows mobile hosts to retain a single IP address with which to communicate via the Internet. A Mobile-IP communication describes the communication of data information to/from a mobile user. In a Mobile-IP communication, the mobile user identifies itself to the BS, providing the BS sufficient information to locate the mobile host. Mobile-IP is included in IS-2000 for CDMA communications and refers to a service in which the mobile user is provided IP routing service to a public IP network and/or secure IP routing service to predefined private IP networks. The MS may use a static IP address or a dynamically assigned IP address of its home IP network. Mobile-IP facilitates smooth PDS communications, wherein the MS selects the service option PDS with Mobile-IP service. The MS has a static Home Address that does not change with MS mobility, but rather associates each MS with its home network. The Mobile-IP allows an MS to maintain a single, constant IP address even when handing off between radio networks connected to separate PDSNs.

Within the Mobile-IP architecture, a Home Agent (HA) and a Foreign Agent (FA) allow a Mobile Host (MH) to retain a single IP address while

moving and connecting to multiple networks. A registration process allows an MS to select a HA. The term Mobility Agent (MA) refers to the HA or the FA. Each MH in a mobile system has an associated home network and a designated HA within the home network. Note that a first HA associated with a first MH of its home network, may also act as a FA for a second MH associated with another network where the second MH is currently visiting the first home network.

The home network and HA are identified by the MH's permanent IP address. When the MH moves out of its home network, it notifies its designated HA of its location. This notification is part of mobility management. Each time the MH changes a network connection, it must notify the HA. As the HA knows the location of the MH, *i.e.*, to which network the MH is connected, any data packets intended for the MH, *i.e.*, addressed to the MH's permanent IP address, are intercepted by the HA. The HA is then able to forward the packets to the MH.

In one application, as the mobile host MS moves to a new network, a FA associated with the new network is able to receive the packets intended for the mobile host from the HA and forward them to the MH. This process is referred to as "tunneling." The HA encapsulates the packets by applying a new IP header directed to the FA. The FA retrieves the packet and identifies the appropriate MH. Alternately, the MH may use a temporary IP address on the foreign network, such as using a Dynamic Host Configuration Protocol (DHCP), and thus retrieve the packet itself. This adds to the complexity of the communication for the MH.

Mobile-IP greatly facilitates the interaction of a variety of mobile devices, allowing transparent host migration in a mobile system. While Mobile-IP describes the communication of data information to/from a mobile user, it is the responsibility of the mobile user to identify itself to the HA. This is in contrast to a voice communication, wherein a Mobile Switching Center (MSC) keeps track of mobile telephone numbers. Mobile-IP is included in the IS-2000 standard for CDMA communication. However, there is no standard method of identifying a target mobile unit from a central controller.

In one embodiment of the present invention, a CDMA communication system establishes a video conferencing call as a PDS service option using Mobile-IP service to identify the mobile units. FIG. 1 illustrates communication system 2, which is capable of wireless and wireline access. Communication system 2 may include any number of

networks; FIG. 1 illustrates one exemplary configuration. Communication system 2 includes wireless networks 5, 15, 25, which represent distinct group of cells within a cellular communication system. Similarly, communication system 2 includes a wireline IP network 10 and a wireline video network 12. Communication system 2 is a CDMA system operating according to the IS-2000 standard, wherein communication system 2 has several service options available for communication between each mobile unit and base station. A first service option is PDS, and a second is a Real-Time Packet Data Service (RTPDS), both incorporating packetized data communications. A third service option is voice communication and a fourth is facsimile.

A first mobile user, MS1 4, is coupled to a first Base Station, BS1 6, via an air interface. BS1 6 receives data information from MS1 4 and other mobile units within its network. MS1 4 selects a service option for communication with BS1 6. In response, BS1 6 coordinates the transmission of information to/from other resources within communication system 2. BS1 6 performs packet control functions on the received data information in preparation for processing by a first Packet Data Service Node (PDSN1 8). For Mobile-IP communications, PDSN1 8 is referred to as Mobile Agent 1 (MA1). When MS1 4 registers with network 5, PDSN1 8 becomes the Home Agent (HA) for MS1 4. The BS1 6 is coupled to the PDSN1 8 via a radio-access-network-to-packet-data-network interface, referred to as "R-P." MS1 4 has an IP address that identifies its location within network 5. PDSN1 8 receives any data packets addressed to the IP addresses of any mobile units within network 5, including those addressed to MS1 4. PDSN1 8 is the Home Agent (HA) for all mobile units associated with network 5 as their home network, *i.e.*, all MSs that have registered with PDSN1 8 as their HA. Note that PDSN1 8 may also act as a Foreign Agent (FA) for visiting mobile units associated with other networks, such as network 15. The PDSN1 8 also communicates with a wireline IP network 10. The connection of PDSN1 8 to a wireline network may be through one or multiple connections including a Public Switched Telephone Network (PSTN) (not shown).

Similarly, within network 15, a second mobile user, MS2 14, is coupled to BS2 16 via an air interface. MS2 14 selects a service option for communication with BS2 16. BS2 16 coordinates information transmission to/from other resources within communication system 2. BS2 16 performs packet control functions on the received data information in preparation for processing by a second PDSN2 18. For Mobile-IP communications, PDSN2

18 is referred to as Mobile Agent 2 (MA2). The BS2 16 is coupled to the PDSN2 18 via R-P interface. MS2 14 has an IP address that identifies its location within network 15. PDSN2 18 receives any data packets addressed to the IP addresses of any mobile units within network 15, including those addressed to MS2 14. PDSN2 18 is the Home Agent (HA) for all mobile units associated with network 15 as their home network. Note that PDSN2 18 may also act as a Foreign Agent (FA) for visiting mobile units associated with another network, such as networks 5 or 25. The PDSN2 18 also communicates with network 10. The connection of PDSN2 18 to a wireline network may be through one or multiple connections including a PSTN. Network 25 is similarly configured, with MS3 24, BS3 26 and PDSN3 28.

Additionally, the wireline video terminal 12 is coupled to wireline IP network 10. Each of the mobile users, MS1 4, MS2 14, MS3 24, are mobile resources within the communication system 2, while wireline video terminal 12 is a wired resource. Each resource is capable of data communication within the communication system 2. In one embodiment, the wireline IP network 10 is an Internet network, and may be an intranet or closed local network in alternate embodiments. In addition to the resources illustrated in the embodiment of FIG. 1, any number and type of resources may have access to the wireline IP network 10.

The mobile units, MS1 4, MS2 14, MS3 24, may be any of a variety of mobile communication devices including but not limited to cellular telephones, electronic personal assistants, mobile computers and other computing devices, car navigational systems, etc. Similarly, each mobile unit may be a different type of device. For example, MS1 4 may be a cellular telephone, while MS2 14 is a laptop computer, and MS3 24 is an electronic personal assistant, or any other such combination. In operation, MS1 4 will register its Mobile-IP with network 5 by providing identification information to BS1 6. This is typically done on activation of MS1 4, but may be performed on occurrence of a specific event. The notification is one step toward enabling the resources of network 5 to locate MS1 4 as it moves throughout communication system 2.

To maintain the continuity of communications and established sessions, such as Point-to-Point Protocol (PPP) sessions or telnet sessions, mobility management functions are performed with respect to each mobile unit. Mobility management keeps track of the location of mobile units, allowing hand-off from one Packet Control Function (PCF) unit (not shown) to another, referred to as PCF-to-PCF hand-off. Mobility management

allows for continuity of such sessions and persistent IP addresses throughout the hand-off by having mobile units register with a HA. Mobility management is performed while MS1 4 is active, so that PDSN1 8 and PDSN2 18 are able to locate MS1 4 when it is the target of a desired communication.

To initiate a communication, MS1 4 will first select a service option and send the service option selection to BS1 6. The appropriate protocols are set up allowing the designated type of communication. In the exemplary embodiment, MS1 4 is capable of selecting a PDS service option for communication of packetized data information. In one aspect of the present invention, the MS1 4 establishes a video conference call by selecting the PDS service option and communicating real-time video information in a packetized format. The PDS allows transmission of the video information at the high data rates associated with packetized data transmission.

While MS1 4 remains within network 5, on receipt of any packetized data addressed to the IP address of MS1 4, PDSN1 8 sends the packetized data to MS1 4 via BS1 6. This includes video information that is transmitted in a packetized data format using a service option such as PDS. Consistent with Mobile-IP, when MS1 4 moves out of network 5 and into network 15, MS1 4 notifies PDSN1 8 and/or PDSN2 18 of its new location to allow forwarding of packets to its new location. In one embodiment, MS1 4 will notify PDSN2 18 of its new location within network 15, and in response, PDSN2 18 will provide this information to PDSN1 8 through the wireline IP network 10.

As the target moves out of its home network into another network, such as illustrated in FIG. 2, in which MS2 14 has moved from network 15 to network 25, the new location adds a complexity to locating the target to initiate a communication. FIG. 2 illustrates the flow of information throughout communication system 2 when a MS moves out of its network and therefore, for clarity, BS1 6, BS2 16, and BS3 26 are not shown. Network 25 includes a PDSN, PDSN3 28, coupled to a BS, BS3 26. The PDSN3 28 communicates with the wireline IP network 10, as do PDSN1 8 and PDSN2 18. As MS2 14 moves into network 25 it retains its IP address as a Mobile-IP and provides this information to PDSN3 28 and PDSN2 18. As the communication continues, PDSN2 18 is no longer able to provide video data information to MS2 14 via BS2 16, as MS2 14 is no longer accessible within network 15. When packets addresses to MS2 14 are received by PDSN2 18, they are forwarded to PDSN3 28. The PDSN3 28 recognizes that MS2 14 is located within its network 25 and forwards the packets via BS3 26.

In this way, PDS is applicable to communications between mobile resources within communication system 2. As the PDS communication continues, both the originator and target are free to move within the system by notifying the appropriate PDSN(s) of their locations. Once the two-way communication is established, both the originator and target become participants in the communication, in which each participant sends and receives information.

As additional foreign mobile users move into a network, the home PDSN acts as a Foreign Agent (FA) and intercepts packets of data addressed to those foreign mobile users. In the exemplary embodiment, the FA provides the new location information to the HA of the Mobile Host (MH), allowing the MH to route the packets appropriately. In this way, the HA will receive the packetized information and will recognize that the MH is not currently located within its home network. The HA then forwards the packet to the FA of the network where the MH is located.

FIG. 2 illustrates the flow of information for either case. As illustrated, MS1 4 sends a packet of information addressed to MS2 14, indicated by path "a," to PDSN1 8. The PDSN1 8 receives the packet and sends it to PDSN2 18, the HA for MS2 14, path "b." If MS2 14 is currently within network 15, PDSN2 18 completes the transaction and sends the packet via path "c." If MS2 14 is not located within network 15, but is in another network, such as network 25, PDSN2 18 encapsulates the packet by applying the IP address associated with PDSN3 28, and sends the packet to PDSN3 28, path "R." At this point, PDSN3 28 receives the packet and strips away the header information to identify the recipient within network 25. PDSN3 28 identifies MS2 14 as within network 25 and forwards the packet to MS2 14 based on the Mobile-IP address specified within the encapsulated packet, path "d." As illustrated by the datagrams of FIG. 2, for data paths a, b, c, and d, the packet contains header information for the IP address or locator of MS2 14. In path R, the packet also includes redirection information with the IP address of PDSN3 28. The redirection information forwards the packet on to the new location.

In an alternate embodiment, the user selects a service option which is specifically applicable to real-time transmissions, such as Real-Time Packet Data Service Option (RTPDSO), which is described in Patent Application entitled "Method and Apparatus for Providing Real Time Packetized Voice and Data Services Over a Wireless Communication Network," having Attorney Docket No. PA000375, assigned to the assignee hereof, and which is

expressly incorporated by reference herein. The RTPDSO provides for transmission of real-time packet data service, and is applicable for low-latency services that do not use a Radio Link Protocol (RLP). The RLP is responsible for re-transmitting data packets when a transmission error occurs. In prior art systems, video and voice over IP did not use RLP. Where the video negotiation protocols do not require a reliable link, the video service may send traffic and control information using RTPDSO. Where a reliable link is required for exchanging video control and negotiation information, the PDSO may be implemented in parallel to the RTPDSO, with the PDSO transmitting control information and the RTPDSO transmitting video traffic.

FIGs. 3 and 4 illustrate, in flow diagram form, a method for wireless video conferencing between mobile units in a system such as communication system 2 of FIG. 1. The process starts as a mobile user originates a packet service call using the appropriate service option. The MS1 4 selects a service option at step 30. The service option specifies a data communication and also indicates how the data is to be transmitted. Additionally, the service option specifies how the data will be used upon receipt. For a mobile-to-mobile data transmission, the service option, PDS, indicates packetized data transmission or high data rate transmission, and identifies the specific protocols to use for the transmission. To use the PDS option for video transmission, a method of identifying mobile units, such as Mobile-IP, is selected and the target resource is identified. For Mobile-IP service, the target identifies its location to the appropriate PDSN(s) and is thereafter locatable when a call originates. Video conference calls are real-time data communications using a two-way connection, and thus require coordination between originator and target, i.e. the participants. While the present example considers a CDMA communication consistent with IS-2000, alternate types of communication systems may also be used in which data is transmitted in a high data rate format and the target resource is identified via a mobile locator. The MS1 4 then requests the service option from BS1 6 and sets up the associated protocols at step 32.

Once BS1 6 receives the request from MS1 4, BS1 6 establishes the service option and communication at step 34. The BS1 6 also performs the packet control function (PCF), preparing the information for PDSN1 8. The MS1 4 then identifies the target resource at step 36. For the present example, the target resource is MS2 14, but in other examples, the target may be any resource with access to the wireline IP network 10 and/or the PDSN1 8. The

target identification is provided to BS1 6 to continue initiation of the conference. The target identification is sent along with the packetized data to the wireline IP network 10. In the present example, target identification is the IP address of MS2 14. The initial data includes video initialization packets for setting up the communication sent as an IP packet. If the target is accessible directly from the wireline IP network 10, *i.e.*, the IP address belongs to a wireline terminal, such as terminal 12, the connection is made directly, step 40. However, if the target is not found at decision 38, and the target is a mobile user, the IP packet is routed to the target IP address. In the configuration illustrated in FIG. 1, MS2 14 is located within its home network 15 and therefore is found through PDSN2 18. Once PDSN2 18 receives the packetized information, step 42, a connection with MS2 14 is attempted. The PDSN2 18 locates MS2 14, step 44. If MS2 14 is located within network 15, and is active and ready to initiate the communication, PDSN2 18 sends the IP packet to MS2 14, step 46. Similarly, if PDSN2 18 recognizes that MS2 14 is in another accessible network, the packet is forwarded to the current location of MS2 14, step 46. Once the initial IP packet is provided to the target, video traffic negotiations begin at step 48.

The process for preparing for a conference call is illustrated in FIG. 4, in which the mobile unit is turned on at step 50. Mobile unit MS2 14 registers with its Home Agent to set up PDS and to register according to Mobile-IP. This information is provided to the wireline IP data network, step 52, to receive requests for initiation of data communication. At step 54 the mobile unit releases the traffic channel and becomes dormant. When a page is received from the BS, decision diamond 56, a video traffic exchange begins, step 60. Note that even when no page is received by the BS, decision diamond 56, the mobile unit performs mobility management functions at step 58. The mobile unit will continue to provide locational information to the BS even when the traffic channel is idle. Various steps may be required to perform mobility management specific to the system, configuration, service option, data transmission format and/or services applied to the communication.

In one embodiment, using Mobile-IP, the mobile originator identifies the target recipient by an IP address or other format. An alternate method of identifying mobile units is the Session Initiation Protocol (SIP), which allows the identification of hosts, including mobile hosts, by a network address identifier referred to as a Universal Resource Identifier (URI). Unlike cumbersome IP addresses with multiple digits of ambiguous

significance, the URI is typically a simplified identifier, such as an e-mail address, which is easy to remember, often has textual significance, and is therefore easy for the originator to enter into the system.

The SIP protocol is an application layer control protocol for creating, modifying, and terminating sessions with one or more participants. SIP is designed for multiparty, multimedia sessions, and supports user mobility via proxy and redirecting servers. SIP is independent of the transport layer protocol and supports user location, user capabilities, user availability, call setup, and call handling. SIP is not dependent on the type of session initiated, but rather provides session initiation and maintenance for interactive communications. The initiation process involves determining where a participant is located in real-time. Once SIP finds the target participant, details of the session are sent, informing the target of the type of session to which it is invited. While SIP does not care about the details of the session, sufficient information is forwarded to the target participant that the target can establish and participate in the session.

Typically, SIP uses Multipurpose Internet Mail Extensions (MIME) to convey the information to the target. MIME is used extensively in web transactions, such as e-mail communications, for describing the session content. In an SIP system, the originator of a call is referred to as the User Agent Client (UAC). The UAC sends a request for a connection, which is referred to as an "INVITE." The INVITE is addressed to the target, and the address is the Universal Resource Locator (URL). The INVITE is sent to a "proxy server" associated with the originator and then forwarded to a proxy server associated with the target. Proxy servers route and deliver messages to recipients within their networks. For example, if an INVITE were sent to asmith@abc.com, the INVITE would be sent to the proxy server of the company abc. When a proxy server receives an INVITE for a mobile user that is not currently located in its network, the proxy server will provide information to the originator's proxy server to redirect the INVITE to the current location of the target recipient.

In one embodiment of the present invention, SIP is implemented to facilitate a conference call within communication system 102 of FIG. 5. The communication system 102 includes first, second, and third wireless networks 105, 115, 125, and a wireline IP network 110. Associated with network 105 is MS1 104 coupled to BS1 106 via an air connection. The BS1 106 is in communication with a SIP server, SIP1 108, via an R-P connection. The SIP1 108 then interfaces with the wireline IP network 110. Each of

networks 115 and 125 is similarly configured, with SIP2 118 and SIP3 128, respectively. The SIP configuration allows the target of an IP communication to be located from a simple URI.

FIGs. 6 and 7 illustrate the operation of system 102 according to two (2) examples. For clarity, the base stations, BS1, BS2, BS3 are not shown. As illustrated in FIG. 6, MS1 104 desires to set up a conference call with MS2 114. MS1 104 sends a message, INVITE, to SIP1 108, the Proxy Server1 of network 105. This first request is indicated by the path labeled "a." In response, SIP1 108 sends the INVITE to SIP2 118, the Proxy Server 2 associated with MS2 114, as indicated by path "b." In this example, the INVITE is sent from SIP1 108 to SIP2 118 via the Internet network 110. At the current time MS2 114 is located within network 115 and therefore SIP2 118 completes the transaction and forwards the INVITE to MS2 114, as indicated by path "c." While MS2 114 remains within network 115, SIP2 118 will direct any received messages to MS2 114. Similarly, SIP2 118 will forward messages from MS2 114 or any other MS within network 115 to MS1 104 or any other MS within network 105 through SIP1 108.

FIG. 7 illustrates the case in which MS2 114 moves out of network 115 into network 125. The mobility of MS2 114 within communication system 102 complicates the session initiation process. Here, MS1 104 again sends an INVITE for MS2 114 to SIP1 108 on path "a" and SIP1 108 forwards the INVITE to SIP2 118 on path "b." At this time, SIP2 118 recognizes that MS2 124 is not located within network 115, but rather is located within network 125. Instead for forwarding the message to network 125, the SIP2 118 sends the URI of SIP3 128, the Proxy Server3 of network 125, to SIP1 108 via path "R." In this way, SIP2 128 is not acting as a proxy, but rather is a Redirect Server. Giving the new location information to SIP1 108 provides SIP1 108 with a more direct path for communicating with MS2 114 in its current location. The INVITE intended for MS2 114 is then sent from SIP1 108 to SIP3 128 on path "d," and forwarded to MS2 114 on path "e." From this point on, communications may proceed directly between SIP1 108 and SIP3 128 without involving SIP2 118.

The datagrams for each of the examples illustrated in FIGs. 6 and 7 provide the details of the communication. For the first case of FIG. 6, the information passing through paths a, b, and c includes the data information with the home IP address for MS2 114 identified within network 115, as the communication is not redirected outside of network 115. The home address for MS2 114 within network 115 is directed to SIP2 118. For example, the

address information may be of the form: MS2@company2, where the network is identified by "company2" and the MS is identified by the prefix. In contrast, for FIG. 7, paths a and b include the home address of MS2 114 within network 115 as header information, but path R replaces the SIP2 associated address with an address associated with SIP3 128. In this case, the address information may be of the form: MS2@company3, where "company3" indicates the network 125. The SIP2 118 sends the message back to SIP1 108, and SIP1 108 extracts the SIP3 128 address information. The message is then resent from SIP1 108 to SIP3 128 with the SIP3 128 address header. Note that the address may take any of a variety of forms. The SIP communication allows the participants to communicate directly even as one or both change networks. Further communications do not go through the home network, but proceed directly to the new location.

One embodiment of the present invention allows for high speed two-way video communication for mobile users. Each mobile user identifies its location to a Packet Data Service Node (PDSN) according to a predetermined format. One embodiment implements a SIP scheme to locate a mobile station as it moves between different radio networks . An alternate embodiment locates mobile users and maintains continuity during PDSN handoffs via Mobile-IP, wherein users periodically provide locational information to a home agent. The real-time video data is provided in a packetized format to allow high data rate transmissions. In a CDMA2000-based system, the mobile users select a PDS service option with Mobile-IP. Note that a PDS service option is still used for the radio interface, but SIP may be selected on top of that service to provide the call set-up functions, such as locating the target mobile.

The present invention provides a novel and improved method of communicating video information in a wireless communication system using at the same rates available for data using in high data rate transmissions. Application of PDS to video communications allows for high speed transmissions of the large volume of video at high data rates for faster, more efficient video communications. In one embodiment, wireless video communication uses a high data rate packet data service and incorporates mobility management techniques. Communications performed via an IP network in which packets of data are directed according to IP-type addresses allow mobile users to transact a video conference call sending the real-time data in packetized format

The previous description of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. The various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without the use of the inventive faculty. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

We claim:

CLAIMS

1. A method for performing a real-time data communication, the method comprising:
selecting a packet data service option;
selecting a target mobile participant;
establishing an Internet protocol (IP) communication with the target mobile participant; and
negotiating traffic with the target mobile participant using the packet data service option.

2. The method of claim 1, wherein the real-time data communication is a video communication.

3. The method of claim 2, wherein the real-time data communication is a code division multiple access (CDMA) communication.

4. The method of claim 2, further comprising:
establishing a Mobile-IP service.

5. The method of claim 4, further comprising:
determining if the target mobile participant has an IP address within a predetermined IP network; and
if the IP address is not within the predetermined IP network, sending a packet of information to a home agent associated with the target mobile participant.

6. The method of claim 3, wherein the establishing an IP communication further comprises:
determining an identifier for the target mobile participant;
sending an invitation addressed to the target mobile participant to a Session Initiation Protocol (SIP) server.

7. The method of claim 6, wherein the establishing an IP communication further comprises:
providing, from the target mobile participant's SIP server, a second identifier for the target mobile participant;
sending an invitation addressed to the target mobile participant using the second identifier.

8. A mobile unit for performing communications according to the method of claim 1.

9. A method for performing a video communication, the method of:
selecting a packet data service option for the video communication;
identifying a target mobile participant;
determining a home agent for the target mobile participant;
locating, from the home agent, the target mobile participant;
sending a first packet of video data to the target mobile participant; and
negotiating video traffic with the target mobile participant.

10. The method of claim 9, wherein the home agent locating the target mobile participant further comprises:
determining a location of the target mobile participant; and
if the target mobile participant is not located within a home network associated with the home agent, redirecting, from the home agent, the first packet of video data to a foreign agent associated with a foreign network where the target mobile participant is located.

11. The method of claim 9, wherein the video communication is a code division multiple access (CDMA) communication.

12. The method of claim 11, wherein the video communication is a video conference call.

13. The method of claim 12, wherein the video conference call is a two-way call.

14. A mobile unit for performing video communications according to the method of claim 9.

15. A mobile unit, comprising:

a first set of computer readable instructions for initiating a packet data service option;

a second set of computer readable instructions for identifying a target mobile participant;

a third set of computer readable instructions for sending a first packet of video data to the mobile participant; and

a fourth set of computer readable instructions for negotiating video traffic with the target mobile participant.

16. The mobile unit of claim 15, wherein the third set of computer readable instructions sends the first packet of video data to a target Session Initiation Protocol (SIP) server associated with the target mobile participant.

17. The mobile unit of claim 16, further comprising:

a fifth set of computer readable instructions for registering a current location of the mobile unit with a home SIP server.

18. The mobile unit of claim 17, wherein the current location is not within a home network associated with the home SIP server.

19. The mobile unit of claim 15, wherein the third set of computer readable instructions sends the first packet of video data to a home agent associated with the target mobile participant.

20. The mobile unit of claim 19, further comprising a fifth set of computer readable instructions for enabling a Mobile-IP service.

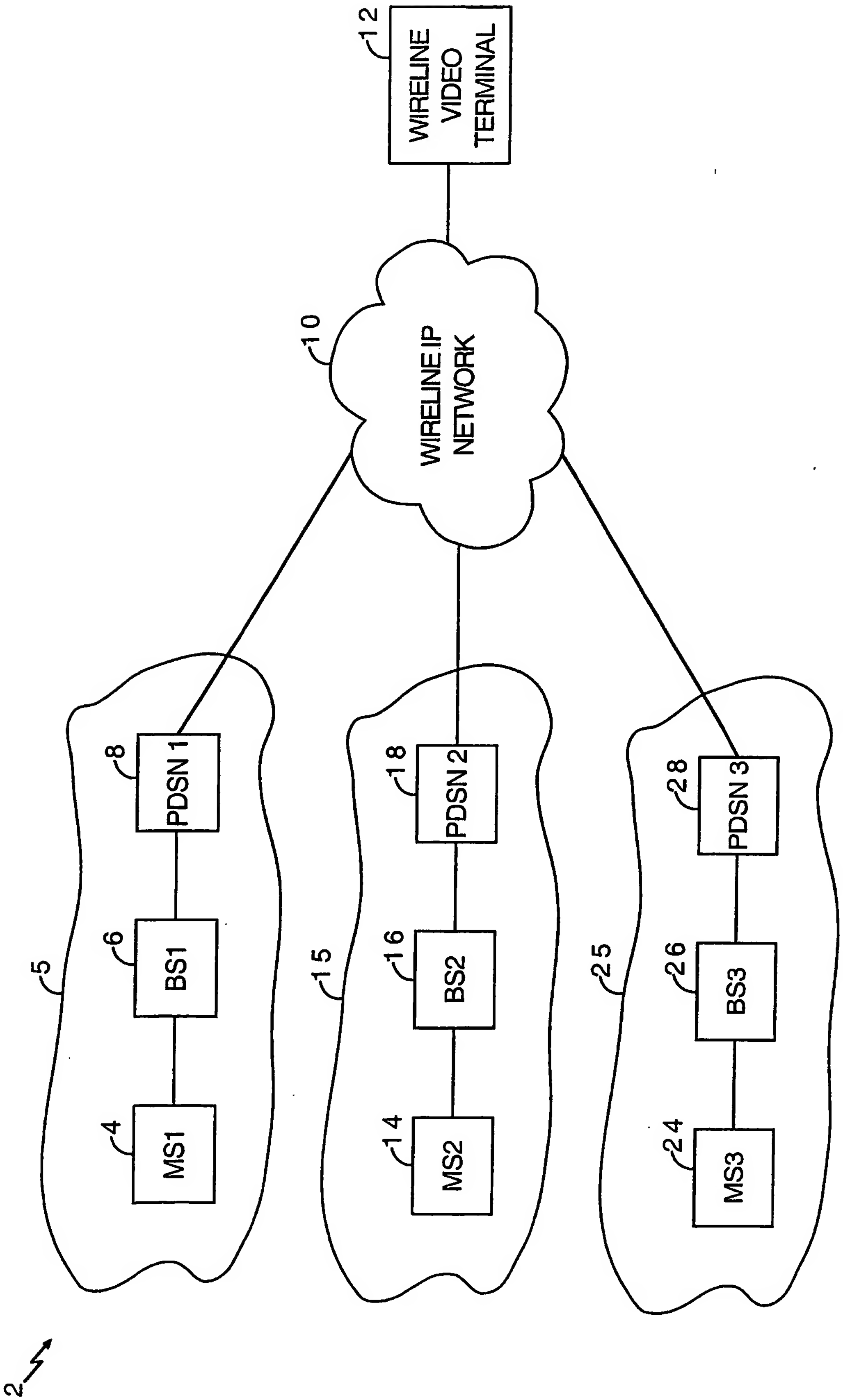
12
WIRELINE VIDEO TERMINAL
10
WIRELINE IP NETWORK
5
8
PDSN 1
6
BS1
4
MS1
15
18
PDSN 2
16
BS2
14
MS2
25
28
PDSN 3
26
BS3
24
MS3
2

FIG. 1

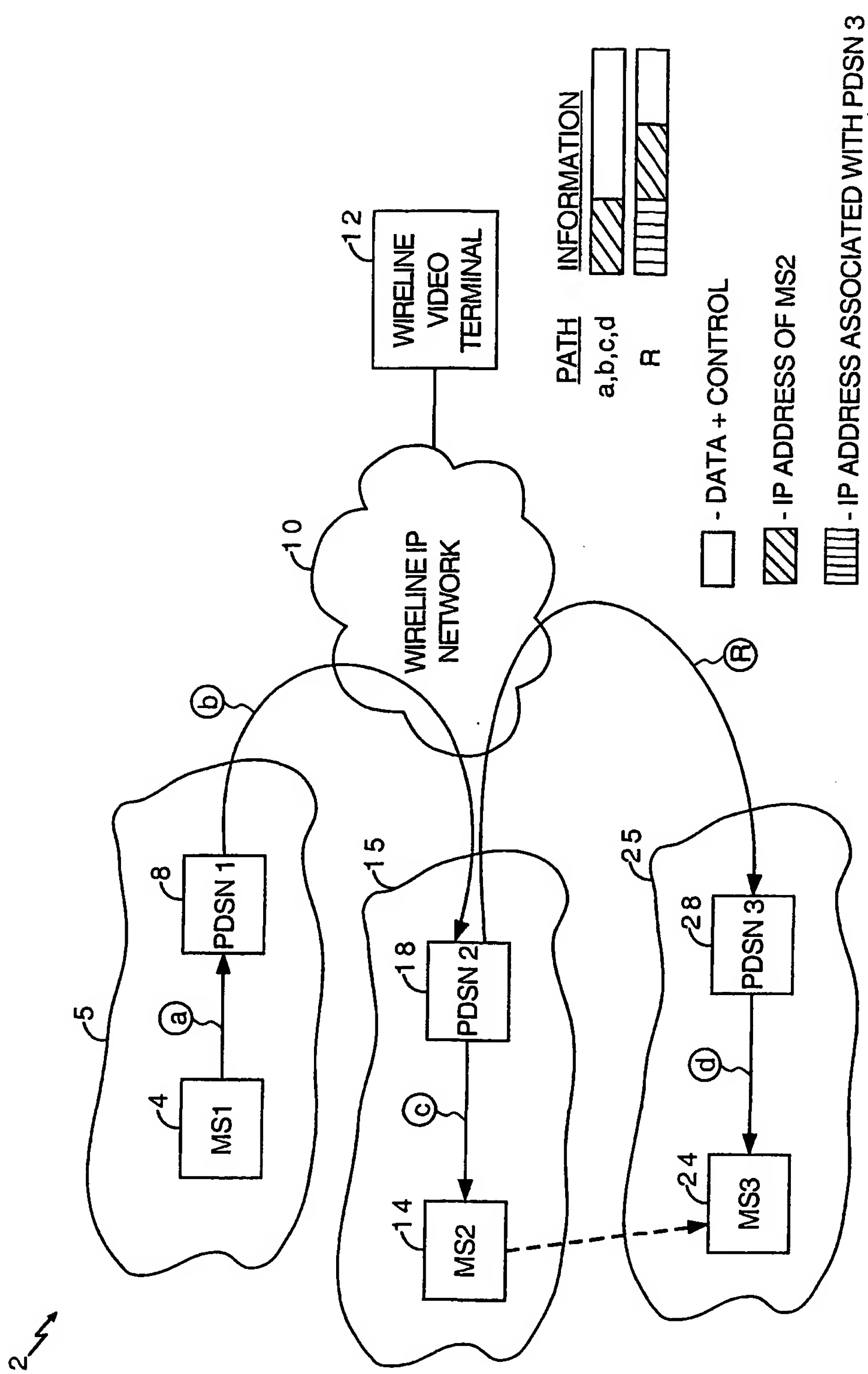
2
5
4
MS1
a
8
PDSN 1
b
15
18
PDSN 2
c
14
MS2
25
28
PDSN 3
d
24
MS3
R
10
WIRELINE IP NETWORK
12
WIRELINE VIDEO TERMINAL
PATH
INFORMATION
a,b,c,d
R
- DATA + CONTROL
- IP ADDRESS OF MS2
- IP ADDRESS ASSOCIATED WITH PDSN 3

FIG. 2

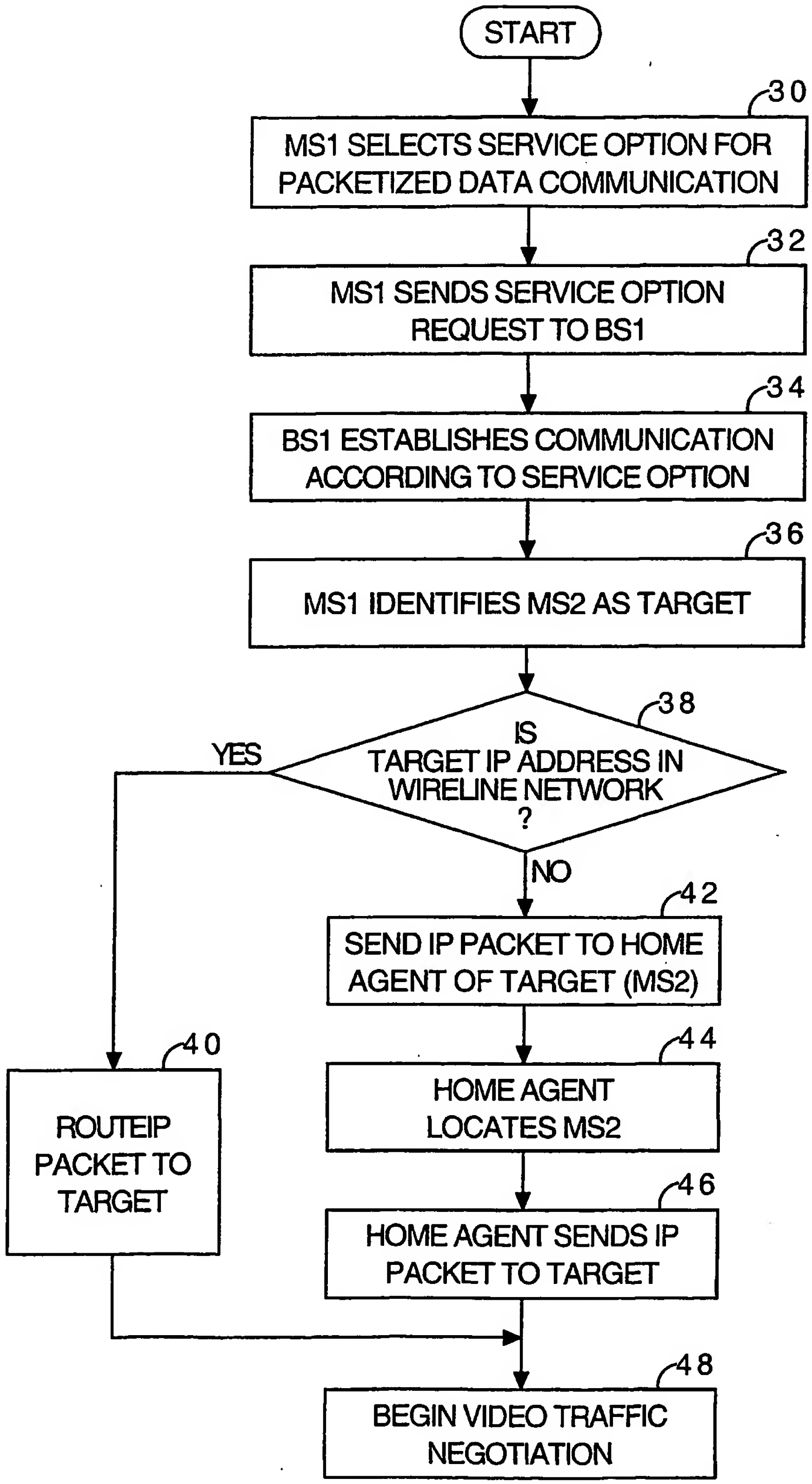
START
30
MS1 SELECTS SERVICE OPTION FOR PACKETIZED DATA COMMUNICATION
32
MS1 SENDS SERVICE OPTION REQUEST TO BS1
34
BS1 ESTABLISHES COMMUNICATION ACCORDING TO SERVICE OPTION
36
MS1 IDENTIFIES MS2 AS TARGET
38
IS TARGET IP ADDRESS IN WIRELINE NETWORK ?
YES
NO
42
SEND IP PACKET TO HOME AGENT OF TARGET (MS2)
40
ROUTEIP PACKET TO TARGET
44
HOME AGENT LOCATES MS2
46
HOME AGENT SENDS IP PACKET TO TARGET
48
BEGIN VIDEO TRAFFIC NEGOTIATION

FIG. 3

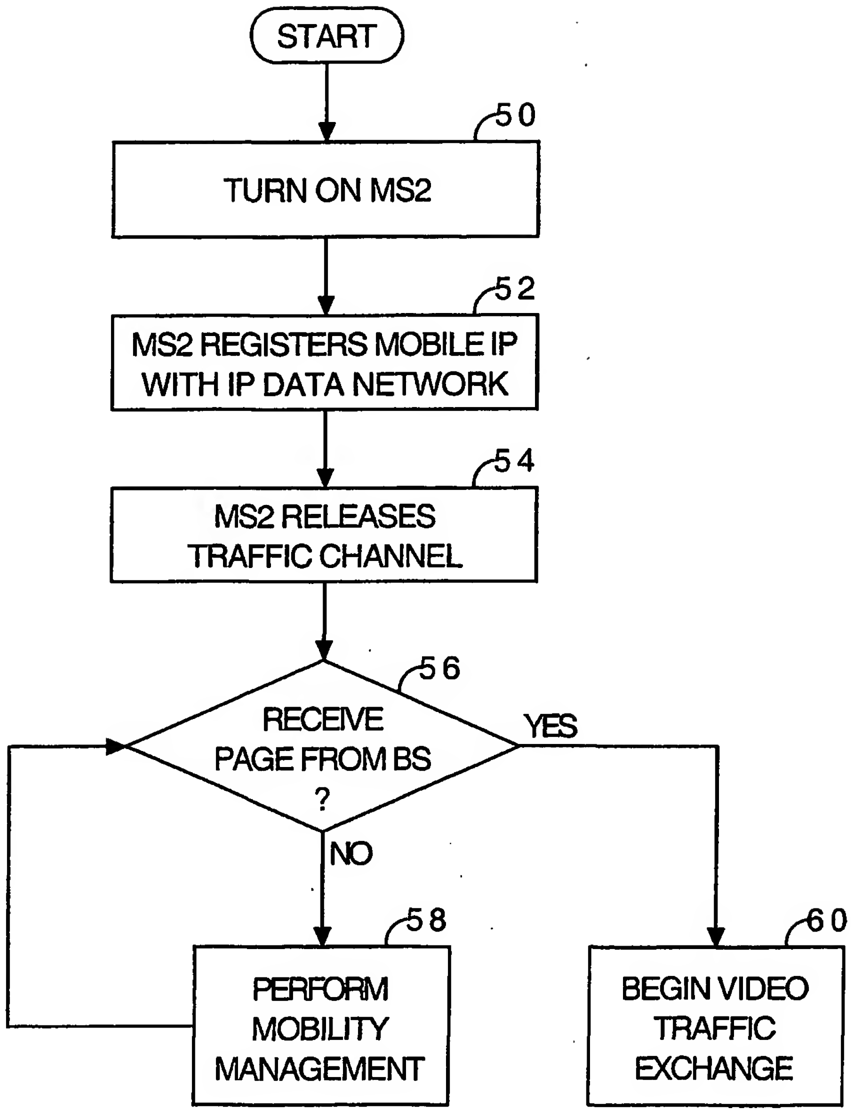
START
50
TURN ON MS2
52
MS2 REGISTERS MOBILE IP WITH IP DATA NETWORK
54
MS2 RELEASES TRAFFIC CHANNEL
56
RECEIVE PAGE FROM BS ?
YES
NO
58
PERFORM MOBILITY MANAGEMENT
60
BEGIN VIDEO TRAFFIC EXCHANGE

FIG. 4

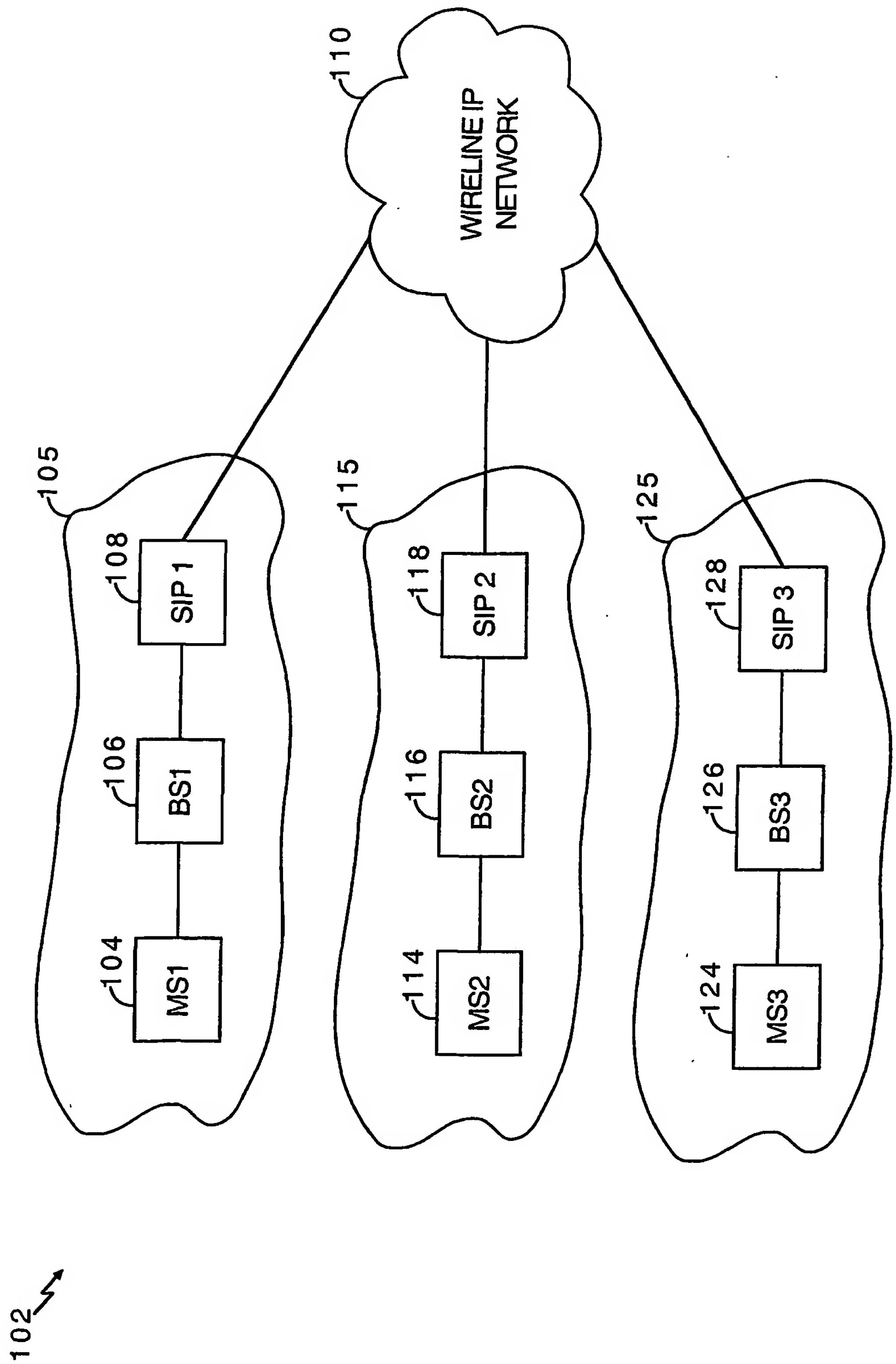
110
WIRELINE IP NETWORK
105
115
125
108
SIP 1
106
BS1
104
MS1
118
SIP 2
116
BS2
114
MS2
128
SIP 3
126
BS3
124
MS3
102

FIG. 5

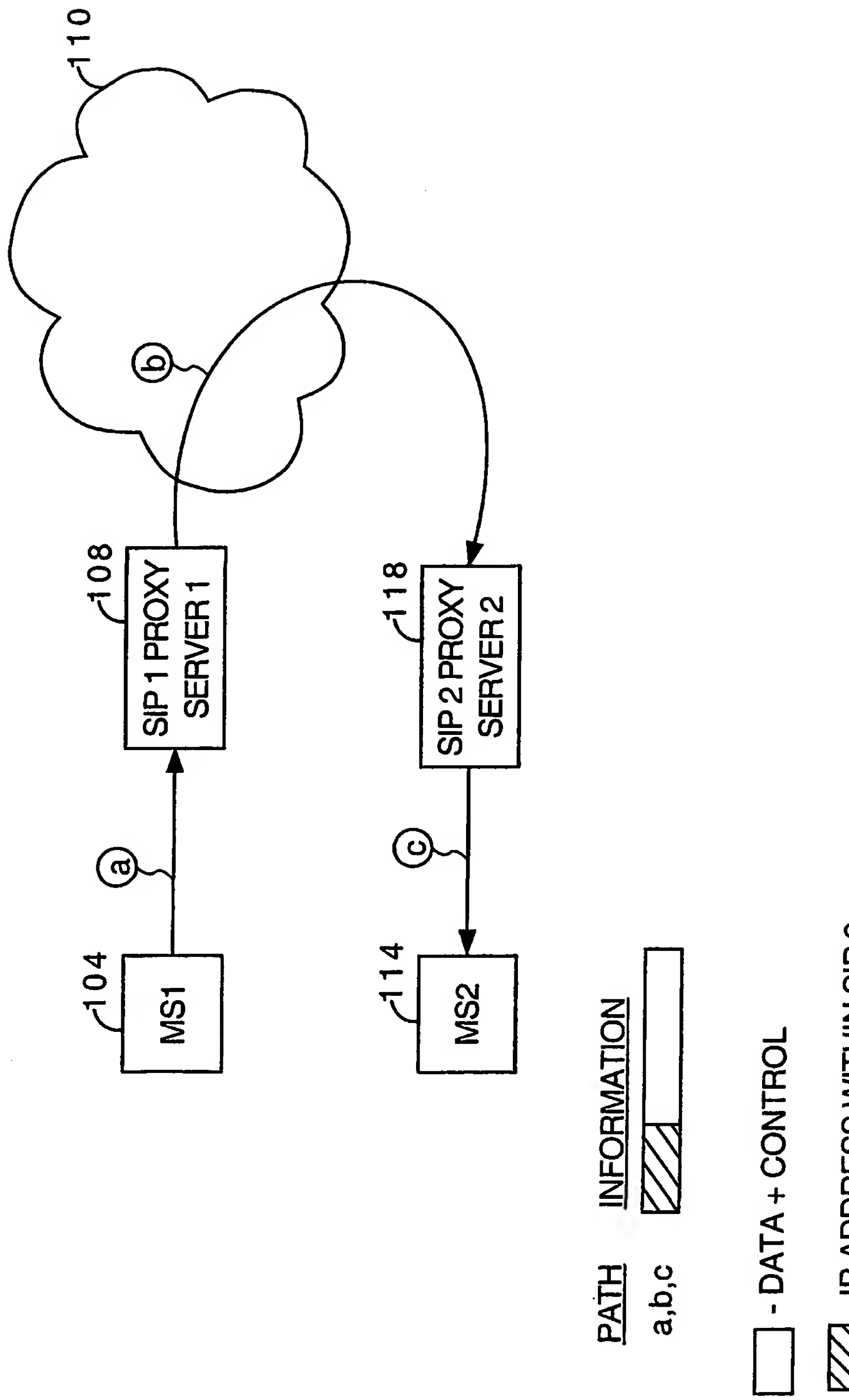
110
b
108
SIP 1 PROXY SERVER 1
118
SIP 2 PROXY SERVER 2
a
c
104
MS1
114
MS2
PATH
INFORMATION
a,b,c
- DATA + CONTROL
- IP ADDRESS WITHIN SIP 2

FIG. 6

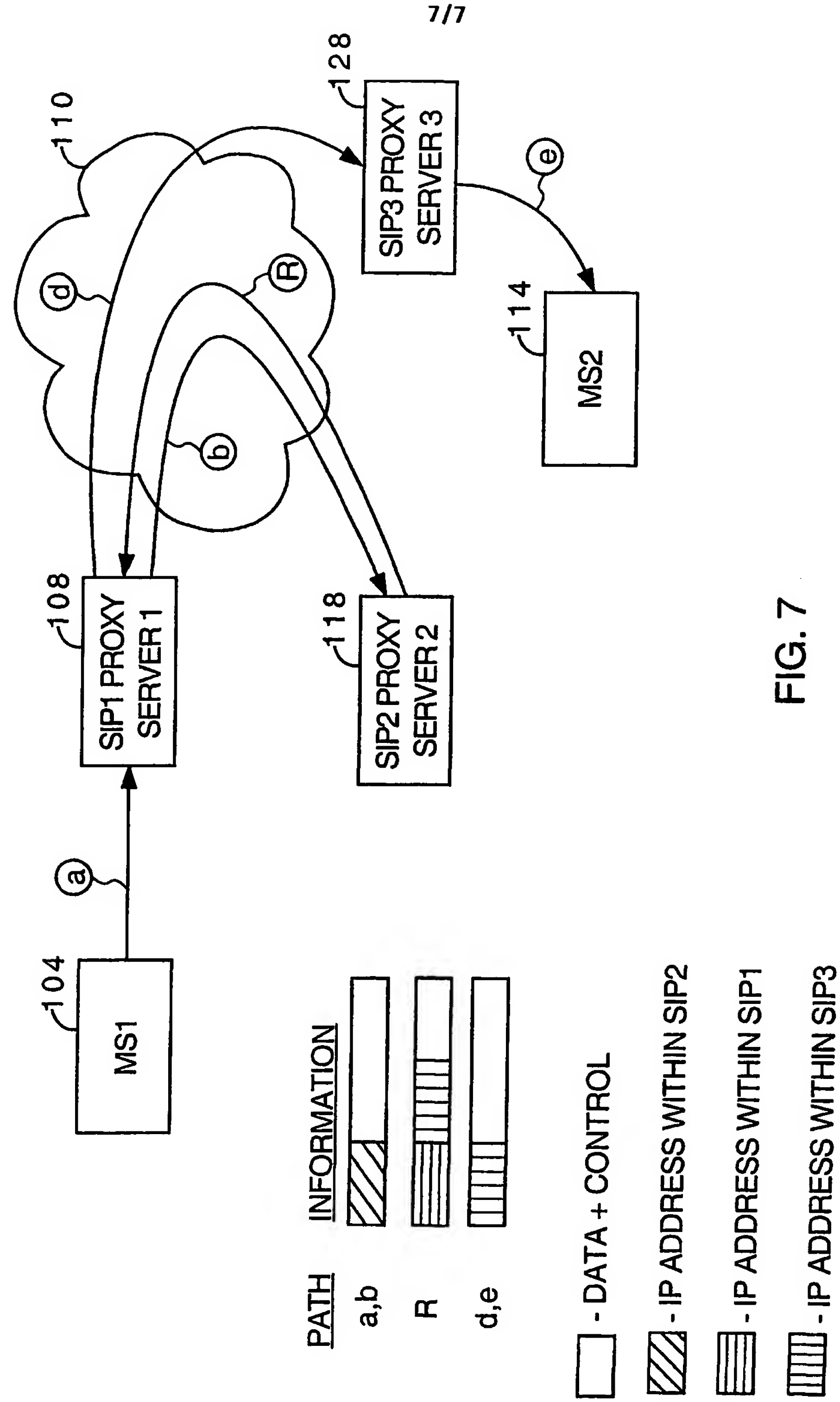
110
128
SIP3 PROXY SERVER 3
e
d
R
114
MS2
b
108
SIP1 PROXY SERVER 1
118
SIP2 PROXY SERVER 2
a
104
MS1
PATH
INFORMATION
a,b
R
d,e
- DATA + CONTROL
- IP ADDRESS WITHIN SIP2
- IP ADDRESS WITHIN SIP1
- IP ADDRESS WITHIN SIP3

FIG. 7

INTERNATIONAL SEARCH REPORT

.ional Application No
ru i/US 01/25574

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/06 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KNISELY D N ET AL: "EVOLUTION OF WIRELESS DATA SERVICES: IS-95 TO CDMA2000" IEEE COMMUNICATIONS MAGAZINE, IEEE SERVICE CENTER. PISCATAWAY, N.J, US, vol. 36, no. 10, 1 October 1998 (1998-10-01), pages 140-149, XP000785922 ISSN: 0163-6804	1-5, 8-15,19, 20
Y	abstract page 140, left-hand column, paragraph 1 -page 141, left-hand column, paragraph 4 page 144, right-hand column, paragraph 5 -page 146, right-hand column, paragraph 3 figures 2,3; table 1 --- -/--	6,7, 16-18

[X] Further documents are listed in the continuation of box C. [ ] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 November 2001	05/12/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Rosken, W

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	MOH M ET AL: "Mobile IP telephony: mobility support of SIP" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON COMPUTER COMMUNICATIONS AND NETWORKS, XX, XX, 11 October 1999 (1999-10-11), pages 554-559, XP002143545	6,7, 16-18
A	the whole document	4,5,9, 10,19,20
A	TIA/EIA INTERIM STANDARD: "Data Service Options for Spread Spectrum Systems: High Speed Packet Data Services" TIA/EIA/IS-707-A.9, March 1999 (1999-03), XP002183111 page 1-1, line 1 - line 18 page 1-4 -page 1-6 page 4-1, line 1 - line 16	1,3-5, 8-11,14, 15,19,20
A	VAKIL F ET AL: "Mobility Management in a SIP Environment - Requirements, Functions and Issues " IEFTL INTERNET DRAFT, 'Online! March 2000 (2000-03), XP002183112 Retrieved from the Internet: <URL:http://www.cs.columbia.edu/sip/drafts/draft-itsumo-sip-mobility-req-01.txt> 'retrieved on 2001-11-15! the whole document	6,7, 16-18